

Title: “The Unfair Fair”

Brief Overview:

In a carnival setting, students investigate three games to determine if the games are “fair” or “unfair” and use data to justify their reasoning.

Links to NCTM 2000 Standards:

- **Standard 1: Number and Operation**

Students will demonstrate that they understand numbers, ways of representing numbers, relationships among numbers, and number systems; understand the meaning of operations and how they relate to each other; and can use computational tools and strategies fluently and estimate appropriately.

- **Standard 4: Measurement**

Students will demonstrate that they understand attributes, units, and systems of measurement; and can apply a variety of techniques, tools, and formulas for determining measurements.

- **Standard 5: Data Analysis, Statistics, and Probability**

Students will demonstrate that they are able to pose questions and collect, organize, and represent data to answer those questions; interpret data using methods of exploratory data analysis; develop and evaluate inferences, predictions, and arguments that are based on data; and understand and apply basic notions of chance and probability.

- **Standard 6: Problem Solving**

Students will demonstrate that they are able to build new mathematical knowledge through their work with problems; develop a disposition to formulate, represent, abstract, and generalize in situations within and outside mathematics; apply a wide variety of strategies to solve problems and adapt the strategies to new situations; and monitor and reflect on their mathematical thinking in solving problems.

- **Standard 8: Communication**

Students will demonstrate that they are able to organize and consolidate their mathematical thinking to communicate with others; express mathematical ideas coherently and clearly to peers, teachers, and others; extend their mathematical knowledge by considering the thinking and strategies of others; and use the language of mathematics as a precise means of mathematical expression.

- **Standard 9: Connections**

Students will demonstrate that they can recognize and use connections among different mathematical ideas; understand how mathematical ideas build on one another to produce a coherent whole; and recognize, use, and learn about mathematics in contexts outside of mathematics.

- **Standard 10: Representation**

Students will demonstrate that they are able to create and use representations to organize, record, and communicate mathematical ideas; develop a repertoire of mathematical representations that can be used purposefully, flexibly, and appropriately; and use representations to model and interpret physical, social, and mathematical phenomena.

Links to National Science Education Standards:

- **Unifying Concepts and Processes**

Students will develop an understanding of evidence, models, and explanation; and develop an understanding of change, constancy, and measurement.

- **Science as Inquiry**

Students will be able to ask questions about objects; employ simple equipment to gather data; use data to construct a reasonable explanation; and communicate investigations and explanations.

- **Physical Science**

Students will develop understanding of objects and materials; and develop understanding of position and motion of objects.

Grade/Level:

Grades 3-6

Duration/Length:

5 days (45 to 50 minutes per day)

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Measurement using centimeters
- Constructing graphs (line plot, stem and leaf graph, bar graph, scatter plot, probability scale, and pictograph)
- Decimals (money)
- Components of a Persuasive Letter

Student Outcomes:

Students will:

- use reading strategies (preview, predict, recall, picture walk).
- be able to respond to prompt using the writing process.
- make predictions.
- collect, organize, analyze, and display data.
- construct line plot, stem and leaf plot, bar graph, scatter plot, and pictograph.
- identify possible solutions to real life problems.
- communicate mathematical data through writing.

Materials/Resources/Printed Materials:

- Literature Book: "Washday on Noah's Ark" by Glen Rounds
- Writing Prompt (Teacher Resource Sheet #1)
- Vignette (Teacher Resource Sheet #2)
- Game Rules and recording sheets (Student Resource Sheets #1A-F)
- Wooden clothespins (one for each student)
- Plastic clothespins (one for each student)

- Bowls with same height sides (wooden, plastic, metal)
- Winning circle template (Teacher Resource Sheet #3)
- Centimeter graph paper
- String
- Paperclips - large (1 box)
- Washers
- Clothesline
- Adding machine tape
- Large clothespin for spinner
- Writing Prompt for Letter (Teacher Resource Sheet #4)
- Rubric for letter (Teacher Resource Sheet #5)
- Metric rulers
- Spinner base template (Teacher Resource Sheet #6)

Development/Procedures:

Day One

1. Teacher will introduce literature book *Washday on Noah's Ark* to students.
2. Students will use their reading strategies to preview and make predictions about the book.
3. The teacher will read the book to the class and lead students in a class discussion to recall students' prior knowledge and to make inferences.
4. Students will respond to writing prompt (Teacher Resource Sheet #1).

Day Two

Drop Everything Game

1. Teacher will have the materials (two kinds of clothespins, bowls, centimeter paper, winning circles- Teacher Resource Sheet #3) prepared for each cooperative student group. Teacher will copy Teacher Resource Sheet #3 template on an overhead transparency; use the overhead projector to enlarge the pattern on a large piece of paper; and cut out the large pattern to use with the Drop Everything Game.
2. Introduce vignette (Teacher Resource Sheet #2).
3. Students will read game rules for Drop Everything Game (Student Resource Sheet #1A).
4. Students will play the game using wooden clothespins and record their data on the recording sheet in the student resource book (Student Resource Sheet #1B).
5. Students use their data to construct a line plot for their cooperative group.
6. Each cooperative group will share their results.
7. Students will repeat the game using plastic clothespins and record their data.
8. Using both sets of data, students will construct a class stem and leaf plot (back-to-back) on the blackboard to display their results.
9. Students will interpret data from both games and communicate orally their analysis of the data.

Day Three

Hang-Ups Game

1. Teacher will have the materials (two kinds of clothespins, string, washers, clothesline, paper clips) prepared for each cooperative student group.
2. Students will read game rules for Hang-Ups Game (Student Resource Sheet #1C).
3. Students play the game and record their data on the recording sheet in the student resource book (Student Resource Sheet #1D).
4. Students use their data to construct a bar graph.

5. Students share their results.
6. Students will interpret data from both games and communicate orally their analysis of the data.

Day Four

Spin the Pin Game

1. Teacher will have the materials (large clothespin spinner, spinner base template) prepared for each cooperative group. (Teacher Resource Sheet #6)
2. Teacher will guide discussion about these terms used to describe probability outcomes:
impossible = outcome will not happen at all
unlikely = outcome probably will not happen
likely = outcome has a good chance of happening
certain = outcome will occur or has occurred already
3. Students will create a human “probability scale” of possible outcomes by standing on adding machine tape line marked with impossible, unlikely, likely and certain.
4. Students will read game rules for Spin the Pin Game (Student Resource Sheet #1E).
5. Students will play the game and record their data on the recording sheet in the student resource book (Student Resource Sheet #1F).
6. Students use their data to construct a pictograph using clothespin symbols to represent each color outcome.
7. Students share their results.
8. Students will interpret data from both games and communicate orally their analysis of the data.

Day Five

Letter to Fairground Manager

1. Teacher will lead a discussion with the students about the characteristics of a “fair” and “unfair” game. Teacher will record on the board students’ evaluation of the games based on these characteristics.
2. Students will analyze their data to determine which of the three games was fair or unfair and discuss their findings with the class.
3. The teacher will review the writing prompt (Teacher Resource Sheet #4) to focus students attention on the purpose of writing a persuasive letter to the manager of the Unfair Fair.
4. The teacher will give an overview of writing rubric (Teacher Resource Sheet #5).
5. Students will write an individual response to the writing prompt.

Performance Assessment:

Students will work in cooperative groups to develop a game that is “fair.” Students must write a description that includes the rules for the game, the materials needed for the game, and the data they collected playing the game. This assessment should also include a graph to represent the data and a written explanation of the students’ analysis of the data. The games, data, and analysis will be presented to the other students and as an evaluative tool for the teacher.

Extension/Follow Up:

- Provide students with materials to design a well-designed investigation to explore which way clothes dry faster, with wind from a fan or hung in the sunshine. (Grades 3 -4)
- Allow students to explore and construct towers of clothespins to investigate the highest and best design. (Grades 3-6)

- Students will create a scatter plot to represent the relationship between the cost of clothespins and amount of weight of washers clothespins held. Analysis of this data will help students design a poster, based on their data, to persuade consumers to purchase the “best buy.” (Grades 5-6)

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Writing Prompt

Recall the details in Washday on Noah's Ark. Think about the way in which Mrs. Noah used the clothespins. Pretend you are an inventor for the New Millennium Laundry Consortium. Write a paragraph describing different uses for clothespins in the future. Be sure to include details in your paragraph about the materials that the clothespins could be made from, the size of the new clothespins, and the cost of the new pins.

Be creative and use your imagination to expand your innovative ideas about the new uses of clothespins.



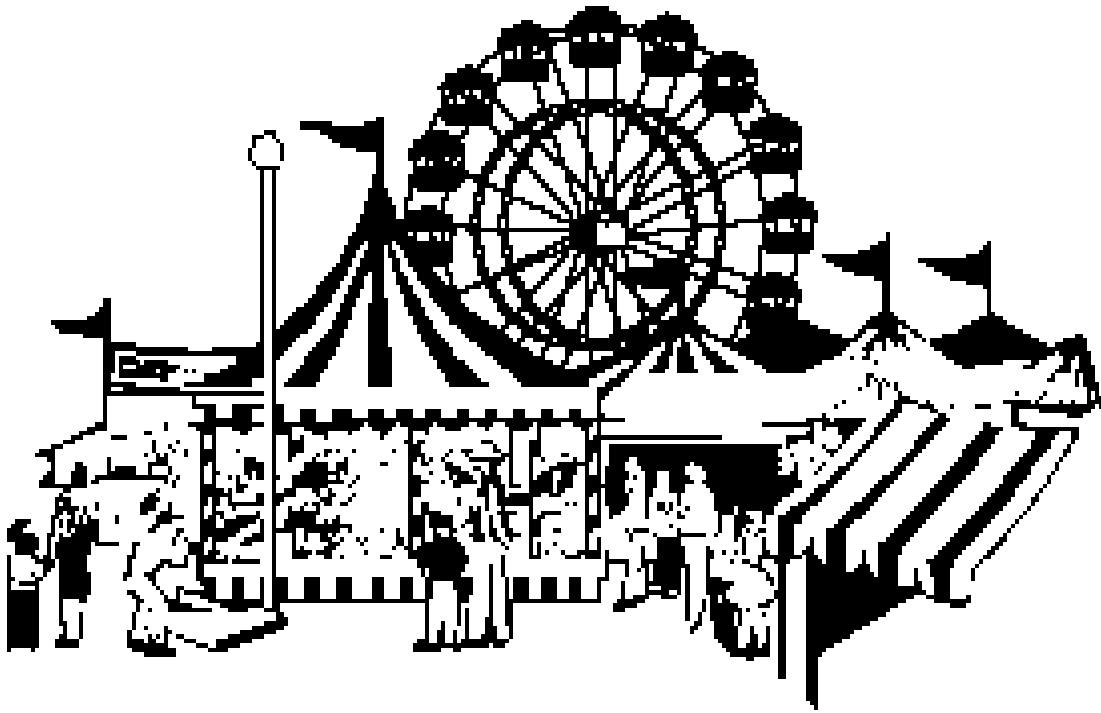
“Unfair” Fair

You and your classmates are finally going to spend the whole day at Five Flags Fair. You only have enough money to play three games and buy a souvenir. You want to play the games where you can win a prize. You decide to observe three games - Drop Everything, Hang-Ups, and Spin the Pin, to see how to win. However, there don't seem to be very many winners.

Investigate these games and decide which ones are fair. Record your data. Write a letter to the games manager about the results of your investigation and suggest any changes that should be made. Use your data to support your recommendations.



The Unfair Fair



Student Name _____

Teacher _____

Game Rules:



Drop Everything

(Game for 4 to 6 players)

1. Place the plastic bowl in the center of the winning circles and stand on the edge of the circle.
2. Keep your arm outstretched parallel to the ground and straight out from your chest. Do NOT lean over the bowl. Drop one wooden clothespin into the center of the bowl.
3. Observe which ring your clothespin bounces into, and measure the distance away from the bowl. Record this on YOUR recording sheet.
* If the pin does not bounce OUT of the bowl, count it as 0 cm.
4. After everyone has completed a turn, repeat the game using the wooden bowl and the wooden clothespin.
5. Repeat steps 1-3 with a metal bowl and wooden clothespin.
6. After everyone has completed a turn with the wooden clothespin and the three bowls, repeat the game using a plastic clothespin and three different bowls. Record your data on your recording sheet.

Drop Everything Game
Recording Sheet



Record in centimeters:

Centimeters of Bounce

Wooden clothespin

Plastic clothespin

Plastic bowl

Wooden bowl

Metal bowl

Hang-Ups



Directions:

(Game for two players)

1. Each player selects a clothespin (plastic or wooden)
2. Each player gets one piece of 60 cm. string
3. Each player ties one end of string onto a paper clip and bends the paper clip to form a hook.
4. Players hang their strings on the clothesline using their clothespins.

*****Now the game begins*****

5. Each player selects one 5-gram washer weight and places it on his/her paper clip.
6. Next, each player selects another 5-gram washer weight and places it on his/her paper clip.

Players continue to place weights on paper clips until clothespin cannot support the weight.

7. Count the number of 5-gram washer weights and calculate the total weight held by the clothespin.
8. Each player records the weight onto the recording sheet.

* The Clothespin that holds the most weight is the winner.



Hang-Ups Hang Time!!!!



Weights
in
Grams

Number
of
Washers

Plastic

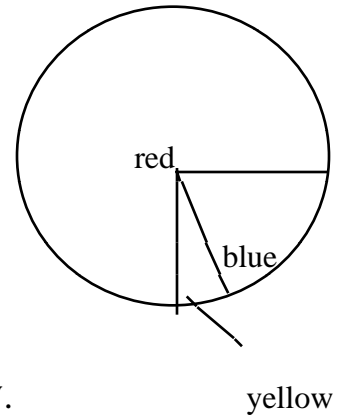
Wooden

Types of Clothespins

Spin the Pin

Directions:

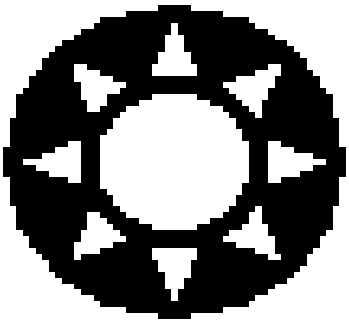
(Up to four players may play)

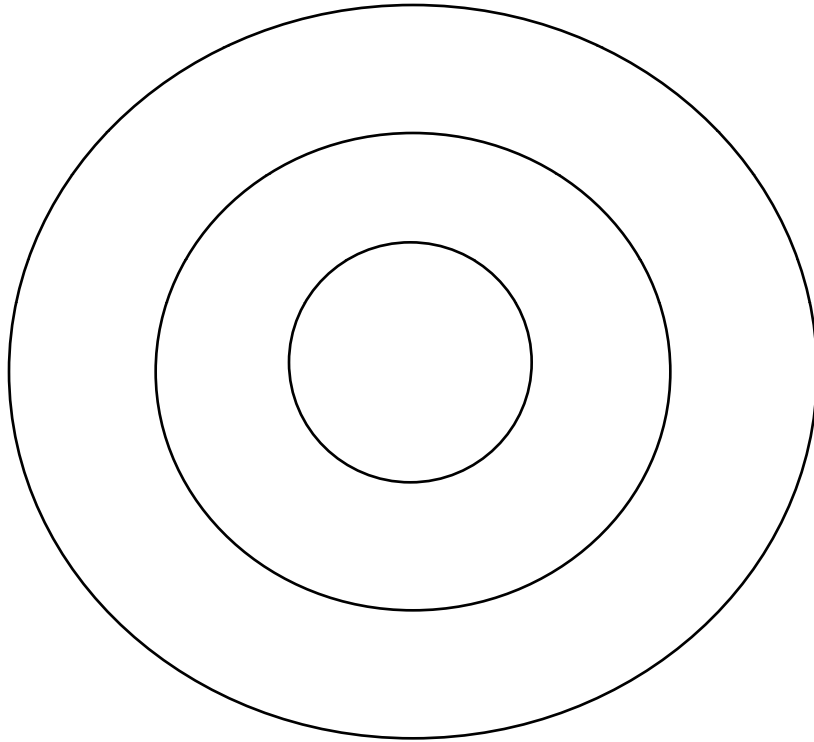


1. Players decide in which order they will play.
2. Each player takes a turn plucking the spinner. Each player will get ten spins.
3. Each player records on the recording tally sheet, the color where the spinner stopped.
4. Total the tallies for each player.
5. The player that has the most yellow tally marks is the winner and game is over.

Spin the Pin Tally Sheet

Color	Player 1	Player 2	Player 3	Player 4
Red				
Blue				
Yellow				





Writing Prompt for Letter



You and your friends have observed that some of the Unfair Fair's games were not very fair. You decide to write a letter to the Games Manager of the Fair and ask him to change some of the games. Use your data to support your suggestions. Be sure to refer to your rubric to include all the parts of a persuasive letter.

Writing to Persuade Rubric

Score Point 4

- I have taken a clear stand on an issue, and I fully support it with appropriate personal or factual information.
- I have presented the opposing view.
- I have chosen numerous specific details that more than adequately explain my stand.
- I have an organization that is logical and does not jump around.
- I understand the type of audience I am writing for.
- I make good language choices to help influence the reader to agree with me.

Score Point 3

- I have taken a clear stand, and I give it some support. The information is presented clearly.
- I have chosen enough specific details to support my stand.
- I have an organization that is logical, but it strays a little.
- I wrote for an intended audience.
- I make some good language choices to help influence the reader to agree with me.

Score Point 2

- I have taken a stand, but I may not have made my position very clear. I tried to support it with some details, but the details may not be the best ones I could have chosen or they are too general or may not really help to explain my position.
- I tried to have organization, but it tends to jump around.
- I tried to understand the audience I was writing for.
- I did not use good language choices to help influence the reader to agree with me.

Score Point 1

- I saw the prompt, and I tried to respond to it. I did not take a stand on the issue. I presented some information but it still is not clear how I stand on the issue.
- I have little or no details.
- I have no real organization.
- I did not try to write for the audience.
- I did not really use language choices to help with style or a tone.

